

THE LOG OF THE LAB

Items of Current Research

FOREST PRODUCTS LABORATORY*

FOREST SERVICE

U. S. DEPARTMENT OF AGRICULTURE

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BETTER JOINTS FOR TIMBER

ALTHOUGH billions of board feet of wood are used every year in America for building purposes, rarely if ever has wood had a chance to demonstrate its full capacity for structural service. Its true merits will be realized through more perfect knowledge of its properties and better engineering means and methods of utilizing them. One favorable development in this direction is the recent improvement of the structural timber joint.

Investigations at the Forest Products Laboratory have largely eliminated the "factor of uncertainty" affecting use of bolts in timber framing. The joint is the critical point of any structure, and the value of the Laboratory's work lies in showing, from the results of hundreds of tests, just what bearing strength is to be expected of a given species and thickness of wood under the pressure of a bolt of a given size, when the pressure comes either lengthwise, side-wise, or at an oblique angle to the grain. Supplementing this information were many tests to determine the proper spacing and marginal

allowances for bolts in the wood. With these data it is now a simple matter to design a joint with no more and no fewer bolts than are necessary to carry safely the load required. The joint becomes a dependable link in a chain of security.

Of even greater interest to the modern structural engineer is the use of inserted metal rings, shear plates, and tooth fastenings for joining timbers together. The split ring and the shear plate fit into precut grooves, while the toothed ring is applied by merely being pressed into the wood as the two members are drawn together by a special bolt and wrench. The advantage of such connectors is that they distribute the load on the wood over a broad area, with fewer bolts and bolt holes than would otherwise be necessary. The net result is that smaller timbers can be used to obtain a given joint strength, and there is a more equal balance of strength in the different parts of the structure.

These jointing devices, referred to collectively as "modern connectors," had their origin in Europe. With their advantages widely recognized there, even more successful use of

* Maintained at Madison, Wis., in cooperation with the University of Wisconsin.

them can be expected in the United States, because of the many structural species of timber available here. In cooperation with the National Committee on Wood Utilization, through whom the aid of foreign manufacturers was obtained, several thousand samples of eight important types of plates, rings, and other connectors were obtained and tested at the Forest Products Laboratory. Data were obtained on the strength of these connectors with two important structural woods, southern pine and Douglas fir. Tests with other species were later included. Design values for split rings have been obtained for joints at different angles with the grain, with various end and edge margins, and with various thicknesses of timber. Similar data are being obtained for other connectors.

To say that wood has entered a new structural era as a result of this development is no exaggeration. Structures are going up that would never before have been thought of in connection with wood. About 200 million feet of timber from the West Coast region alone has already been used in construction employing modern metal connectors, with new adaptations occurring almost daily.

For instance, the radio broadcast tower of the Edgeworth Tobacco Co. station, WRVA, at Richmond, Va., is an all-wood structure, 326 feet high, or 39 feet higher than the Capitol at Washington. It is built of

southern yellow pine and framed with split rings. Recently station WEBC, at Superior, Wis., decided to increase the height of its steel tower from 240 to 360 feet. A wooden base section 120 feet high was built with the aid of modern connectors, and the steel tower was mounted on top. Wood supplies the need, long felt, for a nonconducting material for broadcasting towers; only since the introduction of modern connectors has the necessary height for powerful stations been reached with timber.

A number of forest lookout towers have been constructed of wood, with modern connectors, by the U. S. Forest Service. Last year at Dolan Creek, Calif., a 180-foot arched timber highway bridge was built of redwood, with split rings for the joints and splices. Long timber approaches were built, also framed with the new connectors.

Among numerous structures recently built in the United States with plate or ring connectors are rock and gravel bins at Berkeley, Calif., roof trusses for a large riding hall in Virginia, tank towers, theatres, school auditoriums, and a building for club use. As proved by European experience, the way is open for the use of timber in many other large structures, such as warehouses, railway sheds, and aircraft hangars.

The record of Forest Products Laboratory research on bolted joints is found in U.S.D.A. Technical Bul-

letin No. 332, and on modern connectors in the Laboratory's "Wood Handbook." Both these publications are for sale by the Superintendent of Documents, Government Printing Office, Washington, D. C.

COUNTING THE PLIES

ONE of the first problems encountered by the Forest Products Laboratory in its current investigation of the design of fiber shipping containers was the lack of a satisfactory means of counting the plies in a box board built up of consolidated layers. In the past an alcoholic solution of phenolphthalein has been used as an indicator; applied to the edge of a board, this detector reveals the lines of junction by turning pink in contact with the alkaline adhesive used — usually sodium silicate.

Unfortunately, this test does not always give the reaction desired; for various reasons the alkalinity of the adhesive may be too low to cause the necessary color change in phenolphthalein.

In the search for a more sensitive chemical, many of the common indicators were tried, among which methyl red, phenol red, chlorphenol red, bromphenol blue, and bromthymol blue all proved more satisfactory than phenolphthalein. Methyl red was found to be the best for sharpness of line and permanence of color.

A one-tenth percent solution of methyl red in distilled water is now

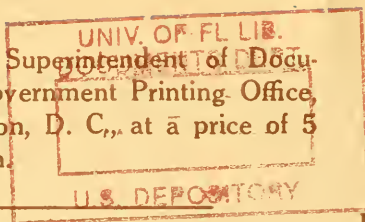
used, and the best results are obtained where the board has been cut with a sharp knife. Adhesives of even the slightest alkalinity, including practically any preparation of casein glue or sodium silicate, are shown as yellow lines on a red field, so distinctly that measurements of the film thickness can be made with either a micrometer microscope or micrometer slide.

This method is simple, accurate, and suited to commercial as well as research use.

NEW MANUAL PUBLISHED — With the purpose of aiding farmers and home owners in the efficient selection of lumber for all common types of construction, a descriptive pamphlet of 45 pages has been published under the authorship of C. V. Sweet and R. P. A. Johnson, Forest Products Laboratory engineers. It classifies all species of lumber commercially available under 28 main types of wood use about the home and farmstead, including exterior siding and trim, flooring for kitchen, living quarters, and porch, interior trim, sash, shelving, roofing, joists and framing, sills, stanchions, managers, silos, concrete forms, fence posts and gates. Qualities of the different woods are explained in direct relation to the service required.

Designated as Farmers' Bulletin No. 1756, "Selection of Lumber for Farm and Home Building," copies of the new publication can be obtained

from the Superintendent of Documents, Government Printing Office, Washington, D. C., at a price of 5 cents each.



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QUESTIONS THE LABORATORY
 IS ASKED

Q. What is applewood, and what is it used for?

A. Applewood is what its name implies, wood from trees of the apple orchard. It is distinctive among commercial species for the exceeding fineness of its pores and the "closeness" of its grain. These characteristics combined with hardness give it unusual finishing and wearing qualities. Handles for carpenters' tools, especially handsaws, probably consume the bulk of applewood. Some apple is used in high-quality plane blocks, tobacco pipes, circular shuttle tops in the textile industry, and other specialties.

Q. What woods are used for baseball bats?

A. The properties required in a good bat are lightness, hardness, and toughness. White ash is generally considered the best wood for this purpose and is by far the most commonly used. Northern hackberry is being used to some extent; if the wood is properly selected, it makes a serviceable bat. Low-priced bats for juvenile use are of many species, but probably of the lower grades of ash for the most part.

Forestry is responsible to the American people for the productive use of hundreds of millions of acres of land — use which will return positive values in employment, human well-being, and community revenue.

It is the crop and utilization value of trees that makes it possible to think of withdrawing vast acreages of submarginal land from agriculture and putting them into forest; we are thinking about productive land use, about people's livings, and the money they can make by cutting fuel and timber and railway ties, selling pulpwood, and supplying the Nation with building materials and manufactured commodities of wood such as it has had in abundance in the past.

The purpose of the Forest Products Laboratory is to aid our great forestry program on the practical, dollars-and-cents side by improving the utilization of wood, making it a more adaptable and satisfactory material for the requirements of modern life. Such utilization is needed to liquidate the billions invested in forest lands by both public and private ownership.

Our effort is to help in establishing not only forests but a permanent forest economy in the United States of America.

(To be continued)